

Federal Railroad Administration

**49 CFR Part 232
Brake System Safety Standards for Freight
Job Aids**

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<div> <div>Freight Equipment</div> <div>Brake Test Matrix (September 2002)</div> </div>					
<div> <ul style="list-style-type: none"> Class I brake tests on Extended Haul trains must be performed by a Qualified Mechanical Inspector (QMI) Class I, IA, II, III and Transfer Train brake tests may be performed by a Qualified Person (QP) or QMI </div>	Type of Brake Test				
	Class I	Class IA	Class II	Class III	Transfer
At a location where train originates operating in excess of 20 miles.	X				
At a location where train consist is changed other than by: <ul style="list-style-type: none"> Adding a single car or solid block of cars¹. Removing a single car or solid block of cars. Removing defective cars. Any combination of the above three bullets. 	X				
At a location where the train is off air for more than four hours, or a location where a unit or cycle train has traveled 3,000 miles since its last Class I Brake test.	X				
At a location where the train is received in interchange if the train consist is changed other than by: <ul style="list-style-type: none"> Removing a car or a solid block of cars from the train. Adding a previously tested car or a previously tested solid block of cars¹ to the train. Changing motive power. Removing or changing the caboose. Any combination of the above four bullets. <i>Note: If changes occurred in the train received in interchange other than those listed above and the train will not move in excess of 20 miles, the railroad may conduct a Class II Brake test on those cars added to the train.</i>	X		X		
At locations (excluding Extended Haul trains), not more than 1000 miles from the point where the train last received its Class I or Class IA brake test. <i>Note: The most restrictive car or block of cars in the train shall determine the location of this test.</i>		X			
At a location other than initial terminal: <ul style="list-style-type: none"> Where a car or solid block of cars is added to a train and has not previously received a Class I brake test or that has been off air for more than four hours, or a location other than initial terminal, where a solid block of cars is added to a train and is comprised of cars from more than one previous train. Each solid block of cars that is comprised of cars from only one previous train, the cars of which have not remained continuously and consecutively coupled together with the train line remaining connected since being removed from the previous train. <i>Note: Each car that receives a Class II brake test as described above shall receive a Class I brake test at the next forward terminal where facilities are available for performing such a test..</i>			X		
At a location when the brake system configuration of the train has changed in any combination of the following: <ul style="list-style-type: none"> A locomotive or a caboose is changed. A car or a block of cars is removed from the train with the consist otherwise remaining intact. At a point other than the initial terminal for the train, where a car or a solid block of cars that is comprised of cars from only one previous train the cars of which have remained continuously and consecutively coupled together with the trainline remaining connected, other than for removing defective equipment, since being removed from its previous train that has previously received a Class I brake test and that has not been off air for more than four hours is added to a train. At a point other than the initial terminal for the train, where a car or a solid block of cars¹ that has received a Class I or Class II brake test at that location, prior to being added to the train, and that has not been off air for more than four hours is added to a train. At a point where it becomes necessary for the controlling locomotive to give up control of the train to another locomotive in the train short of the destination. 				X	
Trains operating a distance not to exceed 20 miles from point of origin to point of final destination.					X
Requires 100 percent operative brakes when Class I Brake Test is made on the entire train..	X				
Requires no less than 85 percent operative brakes at any time.		X	X	X	X
<div> <p>Extended Haul trains may be permitted to move up to, but not exceeding, 1,500 miles between brake tests and inspections if the railroad designates a train as an extended haul train. All of the following reporting requirements shall be met:</p> <ul style="list-style-type: none"> The railroad must designate the train in writing to FRA's Associate Administrator for Safety. The train identification symbol or identification of the location where extended haul trains will originate and a description of the trains that will be operated as extended haul trains from those locations. The origination and destination points for the train. The type or types of equipment the train will haul. The locations where all train brake and mechanical inspections and tests will be performed. <p>Extended Haul trains move in 1,500 mile increments. If the Extended Haul train will move 1,000 or less miles beyond the initial 1,500 miles before receiving a Class IA brake test or reaching destination, a Class I brake test shall be made by a QP or QMI. If the Extended Haul train will move 1,000 miles beyond the initial 1,500 miles before receiving another brake inspection and Class I brake test, the train must be identified as an Extended Haul train and inspected by a QMI and Designated Inspector under §215.11.</p> <p>Any car found with Part 215 defect(s) shall either be repaired or set-out from the train. Cars defective under Part 215 may not be moved in an Extended Haul train from an initial terminal. Extended haul trains may not have more than one pick-up and one set-out en route, except for the set-out of defective equipment. An inspection by a QMI shall be made at the location where the car is set-out from the train to identify defective conditions not in compliance with Part 215 and 231. An inbound inspection shall also be made by a QMI to identify defective conditions not in compliance with Parts 215 and 231, at the point of destination if less than 1,500 miles or at the point designated by the railroad as a location where brake and mechanical inspections are to be performed. The railroad shall maintain written or electronic records of all inoperative, or ineffective brakes as well as any conditions not in compliance with Parts 215 and 231. The inbound inspection requirement will expire on April 1, 2007, unless FRA deems otherwise.</p> <p><i>Note: Failure to comply with one or more conditions stipulated above for Extended Haul trains will be considered a violation of FRA regulations, and subject to the railroad or person to appropriate enforcement action including the possible revocation of the railroads ability to operate Extended Haul trains.</i></p> </div>					

¹ Car or solid block added are comprised of cars from one train and previously received a Class I brake test and have remained continuously and consecutively coupled with the train line remaining connected, except for the setting out of defective equipment since being removed from its previous train, and have not been off air for more than four hours; or the solid block of cars is comprised of cars from one train, but were separated into multiple blocks due to space or track constraints. Under this scenario cars must have previously received a Class I brake test, have not been off air for more than four hours, have remained continuously and consecutively coupled with the train line remaining connected, except for the setting out of defective equipment, and added to the train in the same relative order as when removed from the previous train.

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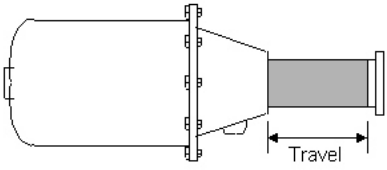
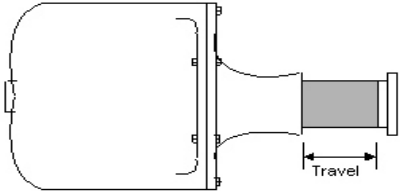
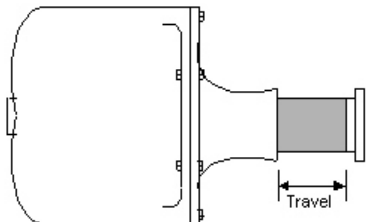
Freight Equipment Brake Test Task Matrix (September 2002)						
Task	<ul style="list-style-type: none">• All tasks relating to Class I brake tests on Extended Haul trains must be performed by a Qualified Mechanical Inspector (QMI)• Tasks relating to all other Class I, IA, II, III and Transfer Train brake tests may be performed by a Qualified Person (QP) or QMI Tasks required for each brake test are identified below	Brake Test				
		Class I	Class IA ¹	Class II	Class III	Transfer
1	Brake pipe leakage shall not exceed 5 psi per minute or air flow shall not exceed 60 cubic feet per minute (CFM).	X	X	X		
2	Leakage test as follows: <ul style="list-style-type: none">• Charge the air brake system to the pressure at which the train will be operated, and the pressure at the rear of the train shall be within 15 psi of the pressure at which the train will be operated, but not less than 75 psi, as indicated by an accurate gauge or end-of-train device at the rear end of train.• Upon receiving the signal to apply brakes for test, make a 20-psi brake pipe service reduction.• If the locomotive used to perform the leakage test is equipped with a means for maintaining brake pipe pressure at a constant level during a 20-psi brake pipe service reduction, this feature shall be cut out during the leakage test.• With the brake valve lapped and the pressure maintaining feature cut out (if so equipped), wait 45-60 seconds, then note that brake pipe leakage as indicated by the brake-pipe gauge in the locomotive, does not exceed 5 psi per minute.	X	X	X		
3	Air flow method (requires 26L or equivalent) as follows: <ul style="list-style-type: none">• Charge the air brake system to the pressure at which the train will be operated, and the pressure at the rear of the train shall be within 15 psi of the pressure at which the train will be operated, but not less than 75 psi, as indicated by an accurate gauge or end-of-train device at the rear end of train.• Measure air flow as indicated by a calibrated AFM indicator, which shall not exceed 60 cubic feet per minute (CFM).	X	X	X		
4	The inspector(s) shall take a position on each side of each car sometime during the inspection process so as to be able to examine and observe the functioning of all moving parts of the brake system on each car in order to make the determinations and inspections required by this section. A "roll-by" inspection of the brake release shall not constitute an inspection of that side of the train for purposes of this requirement.	X	X			
5	The train brake system shall be charged to the pressure at which the train will be operated, and the pressure at the rear of the train shall be within 15 psi of the pressure at which the train will be operated, but not less than 75 psi, angle cocks and cutout cocks shall be properly positioned, air hoses shall be properly coupled and shall not kink, bind, or foul or be in any other condition that restricts air flow. An examination must be made for leaks and necessary repairs made to reduce leakage to the required minimum. Retaining valves and retaining valve pipes shall be inspected and known to be in proper condition for service.	X				
6	The brakes on each car shall apply in response to a 20-psi brake pipe service reduction and shall remain applied until a release of the air brakes has been initiated by the controlling locomotive or yard test device. The brakes shall not be applied or released until the proper signal is given. A car found with brakes that fail to apply or remain applied may be retested and remain in the train if the retest is conducted at an air pressure that is within 15 psi of the air pressure at which the train will be operated. The retest may be conducted from either the controlling locomotive, the head-end of the consist, or with a suitable test device, positioned at one end of the car(s) being retested, and the brakes shall remain applied until a release is initiated after a period which is no less than three minutes. If the retest is performed at the car(s) being retested with a suitable device, the compressed air in the car(s) shall be depleted prior to disconnecting the hoses between the car(s) to perform the retest	X	X	X		
7	For cars equipped with 8½ inch or 10 inch diameter brake cylinders, piston travel shall be within 7 to 9 inches. If piston travel is found to be less than 7 inches or more than 9 inches, it must be adjusted to nominally 7½ inches. For cars not equipped with 8½ inch or 10 inch diameter brake cylinders, piston travel shall be within the piston travel stenciled or marked on the car or badge plate. Minimum brake cylinder piston travel of truck-mounted brake cylinders must be sufficient to provide proper brake shoe clearance when the brakes are released. Piston travel must be inspected on each freight car while the brakes are applied	X				
8	Brake rigging shall be properly secured and shall not bind or foul or otherwise adversely affect the operation of the brake system.	X	X			
9	All parts of the brake equipment shall be properly secured. On cars where the bottom rod passes through the truck bolster or is secured with cotter keys equipped with a locking device to prevent their accidental removal, bottom rod safety supports are not required.	X	X			

¹ A railroad shall designate the locations where Class IA brake tests will be performed, and the railroad shall furnish to the Federal Railroad Administration upon request a description of each location designated. A railroad shall notify FRA's Associate Administrator for Safety in writing 30 days prior to any change in the locations designated for such tests and inspections. Failure to perform a Class IA brake test on a train at a location designated pursuant to this paragraph constitutes a failure to perform a proper Class IA brake test if the train is due for such a test at that location. In the event of an emergency that alters normal train operations, such as a derailment or other unusual circumstance that adversely affects the safe operation of the train, the railroad is not required to provide prior written notification of a change in the location where a Class IA brake test is performed to a location not on the railroad's list of designated locations for performing Class IA brake tests, provided that the railroad notifies FRA's Associate Administrator for Safety and the pertinent FRA Regional Administrator within 24 hours after the designation has been changed and the reason for that change.

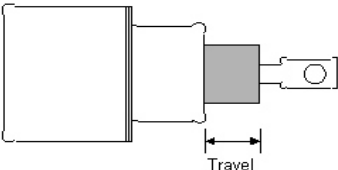
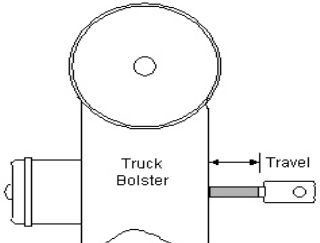
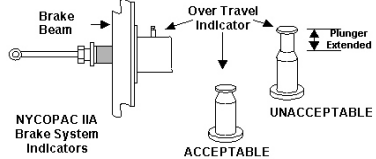
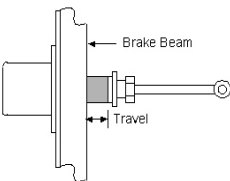
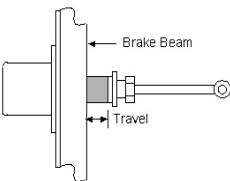
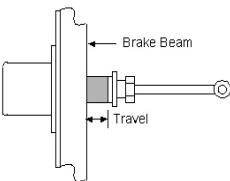
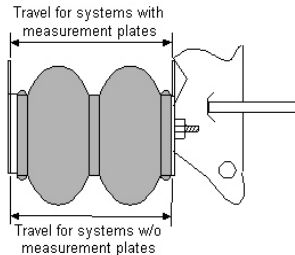
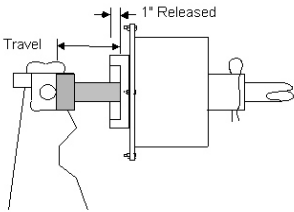
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		Class I	Class IA ¹	Class II	Class III	Transfer
10	When the release is initiated by the controlling locomotive or yard test device, the brakes on each freight car shall be inspected to verify that it did release; this may be performed by a "roll-by" inspection. If a "roll-by" inspection of the brake release is performed, train speed shall not exceed 10 MPH and the qualified person performing the "roll-by" inspection shall communicate the results of the inspection to the operator of the train. The operator of the train shall note successful completion of the release portion of the inspection on the record required as indicated below.	X		X		
11	A railroad shall notify the locomotive engineer that the Class I brake test was satisfactorily performed and provide the information required in this paragraph to the locomotive engineer or place the information in the cab of the controlling locomotive following the test. The information required by this paragraph may be provided to the locomotive engineer by any means determined appropriate by the railroad; however, a written or electronic record of the information shall be retained in the cab of the controlling locomotive until the train reaches its destination. The written or electronic record shall contain the date, time, number of freight cars inspected, and identify the qualified person(s) performing the test and the location where the Class I brake test was performed.	X				
12	Inspections on Extended Haul trains shall also include an inspection pursuant to Part 215 at the initial terminal for the train. The inspection shall be performed by an inspector designated under §215.11. Any car found with the a Part 215 defect shall either be repaired or removed from the train.	X				
13	Before the train proceeds the operator of the train shall know that the brake pipe pressure at the rear of the train is being restored. <i>Note: Each car or solid block of cars that receives a Class II brake test when added to the train shall receive a Class I brake test at the next forward location where facilities are available for performing such a test.</i>			X		
14	The train brake system shall be charged to the pressure at which the train will be operated, and the pressure at the rear of the train shall not be less than 60 psi, as indicated at the rear of the train by an accurate gauge or end-of-train device, and: <ul style="list-style-type: none">• The brakes on the rear car of the train shall apply in response to a 20-psi brake pipe service reduction and shall remain applied until the release is initiated by the controlling locomotive.• When the release is initiated, the brakes on the rear car of the train shall be inspected to verify that it did release.• Before proceeding the operator of the train shall know that the brake pipe pressure at the rear of freight train is being restored.				X	
15	As an alternative to the rear car brake application and release portion of the test, it shall be determined that the brake pipe pressure of the train is being reduced, as indicated by a rear car gauge or end-of-train telemetry device, and then that the brake pipe pressure of the train is being restored, as indicated by a rear car gauge or end-of-train telemetry device. If an electronic or radio communication link between a controlling locomotive and a remotely controlled locomotive attached to the rear end of a train is utilized to determine that brake pipe pressure is being restored, the operator of the train shall know that the air brakes function as intended on the remotely controlled locomotive.			X	X	
16	Whenever the continuity of the brake pipe is broken or interrupted with the train consist otherwise remaining unchanged, it must be determined that the brake pipe pressure of the train is being restored as indicated by a rear car gauge or end-of-train device prior to proceeding. In the absence of an accurate rear car gauge or end-of-train telemetry device, it must be determined that the brakes on the rear car of the train apply and release in response to air pressure changes made in the controlling locomotive.				X	
17	The air brake hoses shall be coupled between all freight cars, and: <ul style="list-style-type: none">• After the brake system is charged to not less than 60 psi as indicated by an accurate gauge or end-of-train device at the rear of the train, a 15-psi service brake pipe reduction shall be made.• An inspection shall be made to determine that the brakes on each car apply and remain applied until the release is initiated by the controlling locomotive.• Cars added to transfer trains en route shall be inspected pursuant to the requirements contained in bullets one and two above at the location where the cars are added to the train. <i>Note: Train movements exceeding 20 miles shall receive a Class I brake test</i>					X
18	Equipment with defective or inoperative power brakes moving under the provisions contained in §232.15.		X	X	X	X
19	Before adjusting piston travel or working on brake rigging, cutout cock in brake pipe branch must be closed and air reservoirs must be voided of all compressed air. When cutout cocks are provided in brake cylinder pipes, these cutout cocks only may be closed and air reservoirs need not be voided of all compressed air.	X	X	X	X	X

¹ A railroad shall designate the locations where Class IA brake tests will be performed, and the railroad shall furnish to the Federal Railroad Administration upon request a description of each location designated. A railroad shall notify FRA's Associate Administrator for Safety in writing 30 days prior to any change in the locations designated for such tests and inspections. Failure to perform a Class IA brake test on a train at a location designated pursuant to this paragraph constitutes a failure to perform a proper Class IA brake test if the train is due for such a test at that location. In the event of an emergency that alters normal train operations, such as a derailment or other unusual circumstance that adversely affects the safe operation of the train, the railroad is not required to provide prior written notification of a change in the location where a Class IA brake test is performed to a location not on the railroad's list of designated locations for performing Class IA brake tests, provided that the railroad notifies FRA's Associate Administrator for Safety and the pertinent FRA Regional Administrator within 24 hours after the designation has been changed and the reason for that change.

**Freight Equipment
Piston Travel Requirements (September 2002)**

Brake Cylinder		Piston Travel at Initial Terminal	Nominal Adjustment	Max. PT Other than Initial Terminal
Body Mounted	10" x 12" Cylinder (Standard)  Also includes: • 8½" x 12" • 7½" x 11" (Max. PT 9 ½") • 7½" x 12" (Max. PT 9 ½") <i>Bushed 7½" x 12" Cylinder</i>	7" - 9"	7½"	10½"
	12" x 10" Cylinder (Standard) 	5" - 7"	5½ "	8½"
	7 5/8" x 12" Cylinder (UC) 	5" - 6"	5½ "	7½"

**Freight Equipment
Piston Travel Requirements (September 2002)**

Brake Cylinder		Piston Travel at Initial Terminal	Nominal Adjustment	Max. PT Other than Initial Terminal
Truck Mounted	Elcon-National 	2¼ " - 3¾ "	2¾ "	4"
	Thrall 	2¾ " - 4¼ "	3¼ "	4½"
		2¼ "	None	2¼ "
	Triax II 	1½ " - 3"	1¾ "	3¼ "
	Wabco-Nycopac 	¾ " - 3"	1¼ "	4"
	Wabcopac II 	1¾ " - 3"	2¼ "	3¼ "
	TTX-TMB (Misner) 	7½ " - 10"	8"	10¼"
	Wabco TMX 	1½ " - 3"	2"	3¼ "

Freight Equipment
Single Car Test & Other Periodic Maintenance (September 2002)

Single car air brake tests shall be performed by a qualified person in accordance with either Section 3.0, "Tests-Standard Freight Brake Equipment," and Section 4.0, "Special Tests," of the Association of American Railroads Standard S-486-01, "Code of Air Brake System Tests for Freight Equipment," contained in the AAR Manual of Standards and Recommended Practices, Section E (January 1, 2001); an alternative procedure approved by FRA pursuant to §232.17; or a modified procedure approved in accordance with the provisions contained in §232.307.

Note: A single car test or repair track air brake test conducted on a car prior to January 1, 2001, pursuant to the existing AAR standards at that time, shall be considered the last single car air brake test for that car, if necessary.

Single Car Test	<p>A railroad shall perform a single car air brake test on a car when:</p> <ul style="list-style-type: none"> • Its brakes cut-out or inoperative when removed from a train or when placed on a shop or repair track. • Its on a shop or repair track for any reason and has not received a single car air brake test within the previous 12-month period. • Its found with missing or incomplete single car air brake test information.
	<p>One or more of the following conventional air brake equipment items is removed, repaired, or replaced on a car:</p> <ul style="list-style-type: none"> • Brake reservoir. • Control valve mounting gasket. • Pipe bracket stud. • Service portion. • Emergency portion. • Pipe bracket.
	<p>A car is found with one or more of the following wheel defects:</p> <ul style="list-style-type: none"> • Built-up tread, unless known to be caused by hand brake left applied. • Slid flat wheel, unless known to be caused by hand brake left applied. • Thermal cracks.
	<p>The car is new or rebuilt, prior to placing it in revenue service.</p>
	<p>Prior to the eighth anniversary date from the when car was built or rebuilt, and no less than every five years thereafter, except when the car is on shop or repair track as indicated above.</p>
Periodic Maintenance	<p>A car on a shop or repair track shall:</p> <ul style="list-style-type: none"> • Be tested to determine that the air brakes apply and remain applied until a release is initiated. • Have its piston travel adjusted to the nominal length of travel if piston travel is found to be below or beyond piston travel limits required at initial terminal, (<i>see chart "Piston Travel Requirements"</i>).
	<p>Before a car is released from a shop or repair track, a qualified person shall ensure:</p> <ul style="list-style-type: none"> • The brake pipe is securely clamped. • Angle cocks are properly located with suitable clearance and properly positioned to allow maximum air flow. • Valves, reservoirs, and cylinders are tight on supports and the supports are securely attached to the car. • Hand brakes are tested, inspected, and operate as intended. • Brake indicators, on cars so equipped, are accurate and operate as intended.
<p><i>Note: If the single car air brake test required by §232.305 cannot be conducted at the point where repairs can be made to the car, the car may be moved after the repairs are made to the next forward location where the test can be performed. Inability to perform a single car air brake test does not constitute an inability to make the necessary repairs.</i></p>	

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Freight & Passenger Equipment Two-Way EOT Exemptions Matrix (September 2002)

All trains, except operations that fall under the descriptions identified below are required to be equipped with Two-Way EOT. Each device shall meet design and performance requirements as stipulated under §232.405.

Note: Each two-way end-of-train device purchased by any person prior to July 1, 1997 shall be deemed to meet the design and performance requirements contained in §232.405.

Exempted Freight Trains	Trains with a locomotive or locomotive consist located at the rear of the train that is capable of making an emergency brake application, through a command effected by telemetry or by a crew member in radio contact with the controlling locomotive.
	Trains operating in the push mode with the ability to effectuate an emergency brake application from the rear of the train.
	Trains with an operational caboose placed at the rear of the train, carrying one or more crew members in radio contact with the controlling locomotive, that is equipped with an emergency brake valve.
	Trains operating with a secondary, fully independent braking system capable of safely stopping the train in the event of failure of the primary system.
	Trains that do not operate over heavy grades and do not exceed 30 mph.
	Local trains, as defined below, that does not operate over heavy grades.
	Work trains, as defined below, that does not operate over heavy grades.
	Trains that operate exclusively on track that is not part of the general railroad system.
	Trains that must be divided into two sections in order to traverse a grade (e.g., doubling a hill). This exception applies only to the extent necessary to traverse the grade and only while the train is divided in two for such purpose.
Exempted Passenger Trains	Passenger trains in which all of the cars in the train are equipped with an emergency brake valve readily accessible to a crew member.
	Passenger trains that have a car at the rear of the train, readily accessible to one or more crew members in radio contact with the engineer, that is equipped with an emergency brake valve readily accessible to such a crew member.
	<p>Passenger trains that have 24 or fewer cars (not including locomotives) in the consist and that are equipped and operated in accordance with the following train-configuration and operating requirements:</p> <ul style="list-style-type: none"> • The total number of cars in a passenger train consist is 12 or fewer, a car located no less than halfway through the consist (counting from the first car in the train) must be equipped with an emergency brake valve readily accessible to a crew member. • The total number of cars in a passenger train consist is 13 to 24, a car located no less than $\frac{2}{3}$ of the way through the consist (counting from the first car in the train) must be equipped with an emergency brake valve readily accessible to a crew member. • Prior to descending a section of track with an average grade of two percent or greater over a distance of two continuous miles, the engineer of the train shall communicate with the conductor, to ensure that a member of the crew with a working two-way radio is stationed in the car with the rearmost readily accessible emergency brake valve on the train when the train begins its descent. • While the train is descending a section of track with an average grade of two percent or greater over a distance of two continuous miles, a member of the train crew shall occupy the car that contains the rearmost readily accessible emergency brake valve on the train and be in constant radio communication with the locomotive engineer. The crew member shall remain in this car until the train has completely traversed the heavy grade.

Heavy grade means:

- Train operating with 4,000 trailing tons or less, a section of track with an average grade of two percent or greater over a distance of two continuous miles.
- Train operating with greater than 4,000 trailing tons, a section of track with an average grade of one percent or greater over a distance of three continuous miles.

Train means:

- One or more locomotives coupled with one or more rail cars, except during switching operations or where the operation is that of classifying cars within a railroad yard for the purpose of making or breaking up trains.
- Local train means a train assigned to perform switching en route which operates with 4,000 trailing tons or less and travels between a point of origin and a point of final destination, for a distance that is no greater than that which can normally be operated by a single crew in a single tour of duty.
- Work train means a non-revenue service train of 4,000 trailing tons or less used for the administration and upkeep service of the railroad.
- Trailing tons means the sum of the gross weights - expressed in tons - of the cars and the locomotives in a train that are not providing propelling power to the train.

Freight & Passenger Equipment
Two-Way EOT & En route Failures Requiring Alternative Measures (September 2002)

- En route failure means device is unable to initiate an emergency brake application from the rear of the train due to certain losses of communication (front to rear) or other reasons.
- Loss of communication means a period greater than 16 minutes and 30 seconds.

Freight Trains	<p>Train speed reduced to 30 MPH until ability to initiate emergency application from rear is restored.</p> <p>If a two-way end-of-train device fails en route, the train on which it is installed, in addition to observing the 30-mph speed limitation, shall not operate over a section of track with an average grade of two percent or greater for a distance of two continuous miles, unless alternative measures are provided.</p> <p>Alternative measures for freight trains include:</p> <ul style="list-style-type: none"> • Use of an occupied helper locomotive at the end of the train, and • The helper locomotive engineer shall initiate and maintain two-way voice radio communication with the engineer on the head end of the train; this contact shall be verified just prior to passing the crest of the grade, and • If there is a loss of communication prior to passing the crest of the grade, the helper locomotive engineer and the head-end engineer shall act immediately to stop the train until voice communication is resumed, in accordance with the railroad's operating rules, and • If there is a loss of communication once the descent has begun, the helper locomotive engineer and the head-end engineer shall act to stop the train, in accordance with the railroad's operating rules, if the train has reached a predetermined rate of speed that indicates the need for emergency braking, and • The brake pipe of the helper locomotive shall be connected and cut into the train line and tested to ensure operation. • Use of an occupied caboose at the end of the train with a tested, functioning brake valve capable of initiating an emergency brake application from the caboose. This alternative may be used only if the train service employee in the caboose and the engineer on the head end of the train establish and maintain two-way voice radio communication and respond appropriately to the loss of such communication in the same manner as prescribed for helper locomotives. • Use of a radio-controlled locomotive at the rear of the train under continuous control of the engineer in the head end by means of telemetry, but only if such radio-controlled locomotive is capable of initiating an emergency application on command from the lead (controlling) locomotive. <p><i>Note: If a two-way end-of-train device fails en route while the train on which it is installed is operating over a section of track with an average grade of two percent or greater for a distance of two continuous miles, the train shall be brought safely to a stop at the first available location in accordance with the railroad's operating rule, except the train may continue in operation if the railroad provides one of the alternative measures detailed above.</i></p>
Passenger Trains	<p>Passenger trains shall not operate over a section of track with an average grade of two percent or greater over a distance of two continuous miles until an operable two-way end-of-train device is installed on the train or an alternative method of initiating an emergency brake application from the rear of the train is achieved.</p> <p>Alternative measures for passenger trains include:</p> <ul style="list-style-type: none"> • A member of the train crew shall be immediately positioned in the car which contains the rearmost readily accessible emergency brake valve on the train and shall be equipped with an operable two-way radio that communicates with the locomotive engineer, and • The locomotive engineer shall periodically make running tests of the train's air brakes until the failure is corrected, and • Each en route failure shall be corrected at the next location where the necessary repairs can be conducted or at the next location where a required brake test is to be performed, whichever is reached first.

Movement of Defective Equipment for Repair Matrix (June 2003)										Part I of II
Condition	The movement for repair provisions provide for the conditional movement of FRA defective equipment for repair without civil penalty liability. Failure to observe any condition associated with the applicable provision will deprive the railroad of the benefit of the movement for repair provision, and make the railroad and any responsible individuals liable for civil penalty under the particular regulatory section(s) concerning the substantive defect(s) present on the equipment at the time of movement.	49 CFR								
		§210.9	§215.9	§221.17	§229.9	§230.12	§232.15	§232.303e	USC §20303	
1	A <i>designated inspector</i> shall determine: <ul style="list-style-type: none">That it is safe to move the freight car.The maximum speed and other restrictions necessary for safely conducting the movement.		X							
2	A <i>qualified person</i> shall determine: <ul style="list-style-type: none">That it is safe to move the freight car or locomotive.The maximum speed and other restrictions necessary for safely conducting the movement.				X		X			
3	A steam locomotive owner and/or operator shall determine: <ul style="list-style-type: none">That it is safe to move the locomotive.The maximum speed and other restrictions necessary for safely conducting the movement					X				
4	Noise defective cars or locomotives require inspection and determined safe to move, but movement may be no further than the next forward facility where the noise defective condition(s) can be eliminated.	X								
5	Notification: Person in charge of the train in which the car or locomotive (including steam locomotives), is to be moved shall be notified in writing and inform all other crew members of the presence of the defective equipment and the maximum speed and other restrictions.		X		X	X	X			
6	Tagging Requirements: A tag or card bearing the words "bad order" or "home shop for repairs", shall be securely attached to each side of the freight car, or in the case of locomotives, a tag bearing the words "non-complying locomotive", shall be attached to the control stand on each MU or control cab locomotive and to the isolation switch or near the engine start switch on every other type of locomotive, excluding steam locomotives. In the case of steam locomotives, the tag shall be securely attached to the locomotive. The tag or card shall contain the following information: <ul style="list-style-type: none">The reporting mark and car number or locomotive number.The name of the inspecting railroad or (entity for steam locomotives).The inspection location and date.The nature of each defect.Movement restrictions.The destination for shopping or repair.The signature of the person making the determination for movement under the applicable provision. The following two bullets only apply to §232.15: <ul style="list-style-type: none">The name and job title of the inspector.The signature, or electronic identification, of the person reporting the defective condition . <i>Note: Cards or tags affixed to defective cars or locomotives moving under §232.15 do not require the headings (i.e. "bad order or non-complying locomotive"), but the card must contain the information listed above.</i>		X		X	X	X			
7	Freight Car Safety Standard Defects: If conditions 1, 5 & 6 are met, movement may be made only for the purpose of effecting repairs. If the car is empty, it may not be placed for loading. If the car is loaded, it may not be placed for unloading unless unloading is consistent with determinations made and restrictions imposed under condition 1, and the car is consigned for a destination on the line of haul between the point where the car was found defective and the point where repairs are made, and unloading is necessary for the safe repair of the car. <i>Note: Cars moving defective under §215.9 may move to a location for repair at the railroads discretion, provided all applicable conditions are observed.</i>		X							
8	Locomotive Safety Standard Defects: If conditions 2, 5 & 6 are met, a locomotive that develops a non-complying condition enroute may continue to utilize its propelling motors until the earlier of, the next calendar day inspection, or the nearest forward point where the repairs necessary to bring it into compliance be made. A locomotive developing a non-complying condition enroute may not continue to provide tractive effort past a location where the necessary repairs can be made or the next daily inspection, whichever occurs first. <i>Note: A non-complying locomotive may be moved lite or dead within a yard, at speeds not in excess of 10 miles per hour, without meeting the requirements of conditions 2, 5 or 6, if the movement is solely for the purpose of repair. The carrier is responsible to insure that the movement may be safely made. A dead locomotive may not continue in use following a calendar day inspection as a controlling locomotive or at the head of a train or locomotive consist.</i>					X				
9	Steam Locomotives Defects: If conditions 3, 5 & 6 are met, a steam locomotive that develops a non-complying condition enroute may continue in use until the earlier of, the next calendar day inspection, or the nearest forward point where the repairs necessary to bring it into compliance can be made. A non-complying steam locomotive (defects not occurring enroute), may be moved only as a lite steam locomotive or a steam locomotive in tow, provided Conditions 3, 5 & 6 are met. Cars essential to the movement of the steam locomotive and tender(s), including tool cars and a bunk car, may accompany lite movements. <i>Note: A non-complying locomotive may be moved lite or dead within a yard, at speeds not in excess of 10 miles per hour, without meeting the requirements of conditions 3, 5 or 6, if the movement is solely for the purpose of repair. The steam locomotive owner and/or operator is responsible to insure that the movement may be safely made.</i>					X				

Movement of Defective Equipment for Repair Matrix (June 2003)										Part I of II
Condition	The movement for repair provisions provide for the conditional movement of FRA defective equipment for repair without civil penalty liability. Failure to observe any condition associated with the applicable provision will deprive the railroad of the benefit of the movement for repair provision, and make the railroad and any responsible individuals liable for civil penalty under the particular regulatory section(s) concerning the substantive defect(s) present on the equipment at the time of movement.	49 CFR								
		§210.9	§215.9	§221.17	§229.9	§230.12	§232.15	§232.303e	USC §20303	
10	Freight Cars or Locomotives with Power Brake Defects: If conditions 2, 5 & 6 are met, a freight car or locomotive may only move from the location where it is first found defective to the nearest location where necessary repairs can be made ¹ . The following restrictions also apply: <ul style="list-style-type: none">A freight car or locomotive with inoperative brakes shall not be placed at the rear car of the train.No more than two freight cars with either inoperative brakes or not equipped with power brakes shall be consecutively placed in the same train.Multi-unit articulated equipment shall not be placed in a train if the equipment has more than two consecutive individual control valves cut-out or if the brakes controlled by the valves are inoperative.The movement of the defective freight car or locomotive for repairs is not in a train in which less than 85 percent of the cars have operative and effective brakes.A defective freight car or locomotive may not move under this provision in a train receiving a Class I brake test on the entire train. <i>Note: Cars overdue a Single Car Test move under this provision..</i>						X			
11	Freight Cars and/or Locomotives with Safety Appliance or Power Brake Defects: A freight car or locomotive (including steam locomotives), may move for repair only after the railroad has established the following seven affirmative defenses: <ol style="list-style-type: none">Freight car or locomotive was properly equipped to begin with.Freight car or locomotive became defective while being used by the railroad on its line.Railroad discovered defect prior to movement.Movement was from place where defect first discovered.Repairs could not be made where defect first discovered.The movement was necessary to make such repairs.Freight car or locomotive moved only to the nearest available point where the necessary repairs can be made¹.								X	
12	Freight Cars: A freight car requiring a Single Car Test because repairs triggering a Single Car Test, and cannot be tested at the location where repairs are made may move under this provision. Freight cars moving under this provision shall be tagged on both sides of the car. The tag shall contain the following information: <ul style="list-style-type: none">The reporting mark and car number.The name of the inspecting railroad.The location where repairs were performed and date.Indication whether the car requires a single car air brake test.The location where the appropriate test is to be performed.The name, signature, if possible, and job title of the <i>qualified person</i> approving the move. <i>Note: A car moving under this provision may move to the next forward location for a Single Car Test. For example, if the car is in need of a Single Car Test due to an FRA or AAR wheel defect, the railroad may elect to move the car under this provision and §215.9 (if applicable), and then perform a Single Car Test, once the defective wheel set is replaced.</i>							X		
13	Rear end Marker Device: A marking device that becomes inoperative enroute during the required hours of display, may be moved to the next forward location where the marking device can be repaired or replaced. <i>Note: Defective rolling equipment which, because of the nature of the defect, can be placed only at the rear of a train for movement to the next forward location at which repairs can be made need not be equipped with marking devices. In addition, when a portion of a train has derailed, and a portable marking device is not available, the remainder of the train may be moved to the nearest terminal without being equipped with the marking device.</i>			X						
14	Movement may be subject to additional conditions/restrictions imposed under a Special Notice for Repair.		X		X	X	X			
¹ When making determinations about whether or not a location is the nearest location where necessary repairs can made, inspectors should first determine if the location falls into one or more of the following four categories: <ul style="list-style-type: none">A location where a mobile repair truck is used on a regular basis.A location where a mobile repair truck originates or is permanently stationed.A location at which a railroad performs mechanical repairs other than brake system repairs.A location that has an operative repair track or repair shop. <p>If the location falls into one or more of the above four categories, inspectors must then apply the following guidelines:</p> <ul style="list-style-type: none">Is the location should be accessible to persons responsible for making repairs.Are there hazardous conditions that affect the ability to safely make repairs of the type needed at the location.The nature of the repair and what will it take to fix it.The need for the railroad to have in place an effective means to ensure the safe and timely repair of equipment.Weather conditions creating a hazardous situation.The location doesn't need to be continuously staffed nor does it have to have the ability to effect every type of brake system repair, or perform a Single Car Test.Congestion of work at the location is a non-issue and should not be considered. <p>Distance to the repair location is a key factor but should not be considered the determining factor when determining whether the location is the nearest location where the necessary repairs can be made. The following two safety considerations must also be considered:</p> <ul style="list-style-type: none">The safety of the employees responsible for getting the equipment to or from a particular location.The potential safety hazards involved with moving the equipment in the direction of travel necessary to get the equipment to a particular location <p>Interchange of Defective Equipment: A defective freight car or locomotive may be interchanged provided the delivering railroad has established the seven affirmative defenses, and if:</p> <ul style="list-style-type: none">The connecting or accepting railroad elects to accept the defective freight car or locomotive for such repair.The nearest available location where necessary repairs can be performed on the line of the connecting railroad, is no farther than the nearest available location where necessary repairs can be performed on the line of the railroad where the freight car or locomotive was found defective.										

**Locomotive Sanitary Compartment Exemptions Matrix
(July 2003)**

Except as provided in this matrix, all lead locomotives in use shall be equipped with a sanitation compartment with all of the following: <ul style="list-style-type: none"> • Adequately ventilated. • A door that closes and possesses a modesty lock by October 3, 2003. • A toilet facility, as defined in §229.5. • A washing system, as defined in §229.5, unless the railroad otherwise provides the washing system to employees upon reporting for duty or occupying the cab for duty, or where the locomotive is equipped with a stationary sink that is located outside of the sanitation compartment. • Toilet paper in sufficient quantity to meet employee needs, unless the railroad otherwise provides toilet paper to employees upon reporting for duty or occupying the cab for duty. • A trash receptacle, unless the railroad otherwise provides portable trash receptacles to employees upon reporting for duty or occupying the cab for duty. 	Type of Service				
	Commuter, Short-haul passenger, or Commuter work train	Switching or Transfer	Class III Railroads	Tourist & Excursion	Control Cab
Railroad employees must have ready access to railroad provided sanitation facilities outside of the locomotive or elsewhere on the train that meet the standards, (FRA).	X				
Railroad employees must have ready access to railroad provided sanitation facilities outside of the locomotive that meet otherwise applicable sanitation standards, (OSHA).		X			
Railroad employees must have ready access to railroad provided sanitation facilities elsewhere on the train that meet the standards.					X
Whether the sanitation facility is in a passenger unit or car elsewhere in the train or in a station along the train's route, the sanitation facility must be railroad provided/owned, meet all the requirements of the rule and accessible to cab employees at frequent intervals during the work shift.	X				
Restaurants or other public establishments must not be relied upon to meet the intent of this rule, the railroad must provide the sanitation facility.	X				
Locomotives can operate without a sanitary compartment, if the railroad provides alternate sanitation facilities along the right-of way or yard office, that meet otherwise applicable sanitation standards, and is accessible to cab employees at frequent intervals during the work shift.		X	X	X	
If railroad can not provide alternate sanitation facilities the locomotive must be equipped with a sanitation compartment that meets the standards.		X			
Restaurants or other public establishments with no business connection to the railroad should not be relied upon to meet the intent of this rule			X		
If it's not possible to establish railroad owned sanitation facilities along right-of-way, the railroad must make arrangements with customers or other businesses along the route for the specific purpose of garnering access to adequate sanitation facilities 24 hours a day seven days week, depending on railroad operations and schedule.			X		
The railroad must notify employees as to the locations of the alternate sanitation facilities.			X		
If the employer can not establish alternate sanitation facilities along the right-of-way, the employer must provide immediate accommodations to the employee who requests use of sanitation facilities.				X	
The sanitation facilities must be located elsewhere on the train and meet the requirements of the rule.					X
<i>Note: "Immediate accommodations" means the employer would be required to start the process of providing access to sanitation facilities to the requesting employee (e.g. transporting the employee by vehicle or other conveyance to a toilet), and is used to clarify the term "ready access."</i>					

**Use of Locomotive With a Defective Sanitary Compartment Matrix
(July 2003)**

§229.9 does not apply to §§ 229.137 & 229.139 <ul style="list-style-type: none"> • A locomotive with a defective sanitary compartment does not necessarily render the locomotive defective. • The locomotive may continue in service provided all applicable conditions contained in this matrix or §229.137(c) through (h), are met. • Conditions vary depending on the type of service the locomotive is in, (e.g., lead, trailing, switching and transfer). <p><i>Note: The conditions for use contained in this matrix do not apply if the locomotive develops a defective sanitation compartment enroute. These conditions only apply when the locomotive receives a daily inspection.</i></p>	Locomotive Service		
	Lead	Trailing	Switching or Transfer
When a daily inspection is made, and the sanitary compartment or toilet facility is defective, unsanitary or both, the railroad may use the locomotive provided all applicable conditions listed below are met:	X	X	X
There are no other locomotives available for use or it is not possible to switch the locomotive in the consist with a complying locomotive.	X		
Upon reasonable request by crewmember, the railroad arranges for use of sanitary facilities outside the locomotive that meets otherwise applicable sanitation standards.	X		
The sanitation compartment door is closed and adequate ventilation is provided in the cab so that it is habitable.	X		
The locomotive while non-compliant, did not continue in the lead position beyond a location where repairs could have been made, or where the locomotive can be replaced with a compliant locomotive, or the next daily inspection, whichever occurs first.	X		
<ul style="list-style-type: none"> • Employees shall not be required to occupy the cab unless the sanitation compartment is made sanitary prior to occupancy. • If the toilet facility is defective and employees are required to occupy the cab, the railroad shall clearly mark the toilet facility as unavailable for use. 		X	
If the toilet facility is defective, but sanitary: <ul style="list-style-type: none"> • The toilet facility shall be clearly marked by the railroad toilet facility unavailable for use. • After expiration of 10 days, the locomotive toilet facility must either be repaired or used in the trailing position. 			X
Inadequate Ventilation or Defective Door Closure: <ul style="list-style-type: none"> • Repair the vent/door closure prior to departure. • Move the locomotive to the trailing position in the consist. • Place the locomotive in switching or transfer service. 	X		
Defective Modesty Lock: Repair the lock on or before the locomotive's next 92 day inspection.	X		
Sanitation Servicing Requirements: <ul style="list-style-type: none"> • The lead locomotive cab in use shall be sanitary with all components within the sanitary compartment functioning as intended. • Water shall be present in sufficient quantity to permit flushing. • Toilet systems that use chemicals for the treatment of waste shall be present and there shall be no blockage that prevents waste from evacuating the bowl. • All occupied trailing, switcher and transfer locomotives cabs shall be sanitary. 			